"An invasion of armies can be resisted, but not an idea whose time has come."

Victor Hugo Les Miserables

Advancing Asset Management in Your Utility: A "Hands-on" Approach

Hosted, funded and developed by:



Missouri

Department of Natural Resources



USEPA

Office of Wastewater Management

PARSONS I GHD

PARSONS / GHD

Asset Management Center (PAMC)

AGENDA

<u>Day 1</u>

- Welcome, Introductions & Housekeeping Details
- Background And Context
- Overview Of Fundamental Concepts & Core Practices
- The "Storyline": Tom's Really Bad Day
- Core Question 1: What Do I Have? Where Is It? What Condition Is It In?
- Core Question 2: What Is My Required "Sustainable" Level Of Service?
- Core Question 3: Which Assets Are Critical To Sustained Performance?
- Core Question 4: What Are My Minimum "Life-cycle-cost Strategies?
- Core Question 5: What Is My Required "Annuity Funding Level?"
- Discussion/Q & A; Review of Self-audit

Day 2

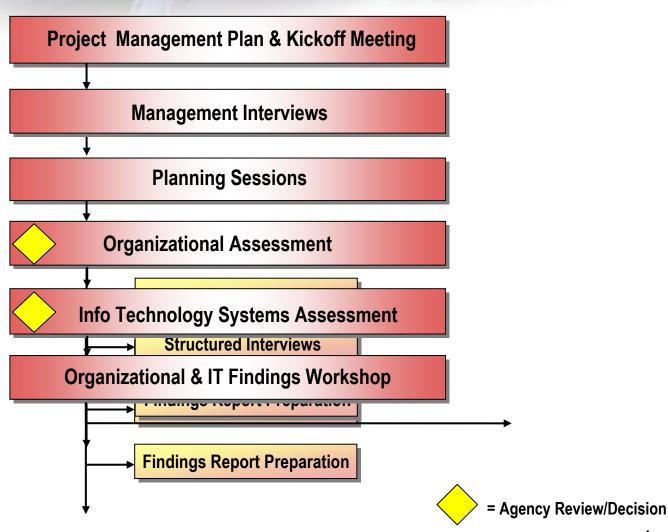
- Summary of Day 1; Outline of Day 2
- Case Study 1: Deploying An AAM Program
- Case Study 2: Developing And Funding A Lowest Life-cycle-cost CIP
- Case Study 3: Meeting The IT Challenge Toward An Enterprise Asset Management System (EAMS)
- Summary, Addressing Your Questions, Comments, Self-audit

AGENDA

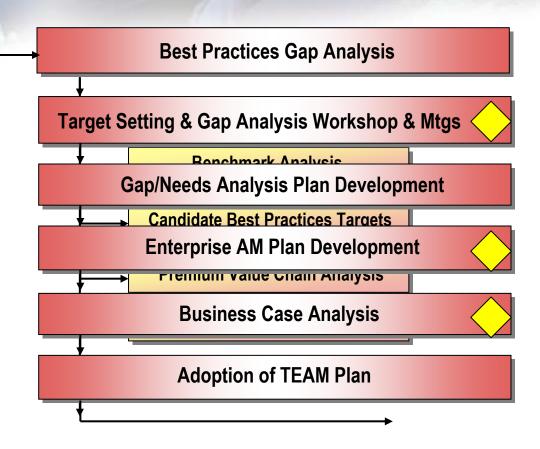
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Typical Deployment Work Plan

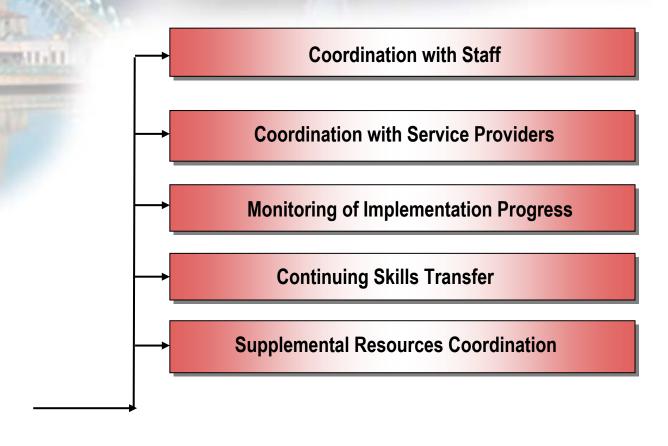


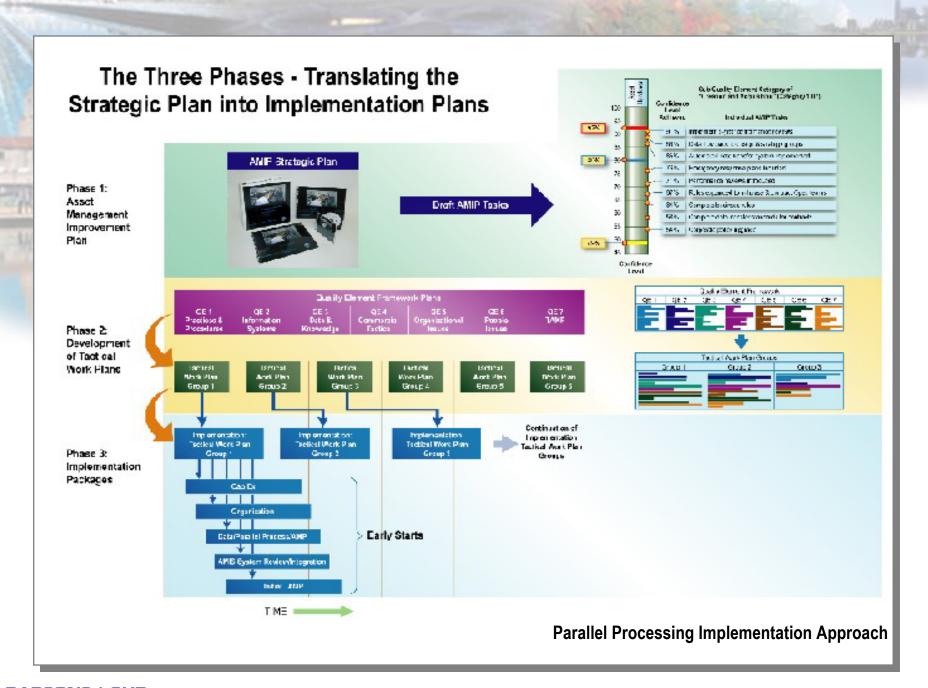
Typical Deployment Work Plan





Typical Deployment Work Plan





Collaboration Ensures Your Success



"These have been the best two days of my working life."

Gary Streed, OCSD Finance Director

Resourcing Options

Adequate Staff **Availability** Proceed Inadequate **Extend Timelines Introduce Contractors -**To do lower level jobs & To do allow promotion to

Staff Jobs

higher duties

Case Study in Developing and Deploying an AAM Program for a Large Utility

Orange County
Sanitation District,
Orange County,
California



AGENDA

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OCSD CIP Review

- Pilot project 15 selected from 190 CIP projects
- Collections to treatment plant projects
- Compared current OCSD practices to AM best practices
- Purpose show insight to better ways to select projects and build CIP

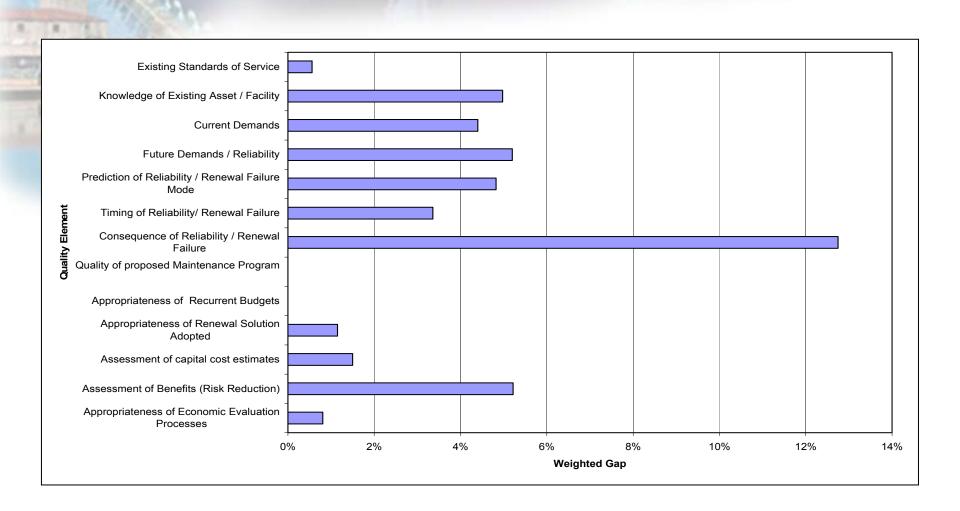
CIP Review (cont)

- Projects audited
 - Quality of processes and practices
 - Quality of data
- Confidence level generated for each project
- Identified weaknesses in projects
- Showed where future improvements could be made

Quality Assessment

No.	Quality Element	Process Effectiveness	Data Quality	Element Quality Rating	Primary Quality Weightings	Project Confidence Level
1	Existing Standards of Service	84%	84%	84%	4%	3.4
2	Knowledge of Existing Assets / Portfolio	63%	56%	59%	12%	7.8
3	Current Demands	78%	78%	78%	8%	6.3
4	Future Demands / Changes in LOS	85%	85%	85%	10%	8.5
5	Prediction of Failure Mode	77%	77%	77%	2%	1.5
6	Timing of Capacity Failure	78%	78%	78%	8%	6.2
7	Consequence of Capacity Failure	58%	53%	55%	20%	11.0
8	Quality of proposed Maintenance Program	58%	53%	56%	2%	1.1
9	Appropriateness of Oper. & Maintce. Costs	75%	75%	75%	2%	1.5
10	Appropriateness of Capital Solution Adopted	79%	79%	79%	15%	11.8
11	Assessment 0f Capital Cost Estimates	85%	85%	85%	7%	6.0
12	Assessment of Benefits	72%	72%	72%	5%	3.6
13	Appropriateness of Economic Evaluation Processes	70%	70%	70%	5%	3.5
	TOTALS				100%	72

Weighted Gap Improvements

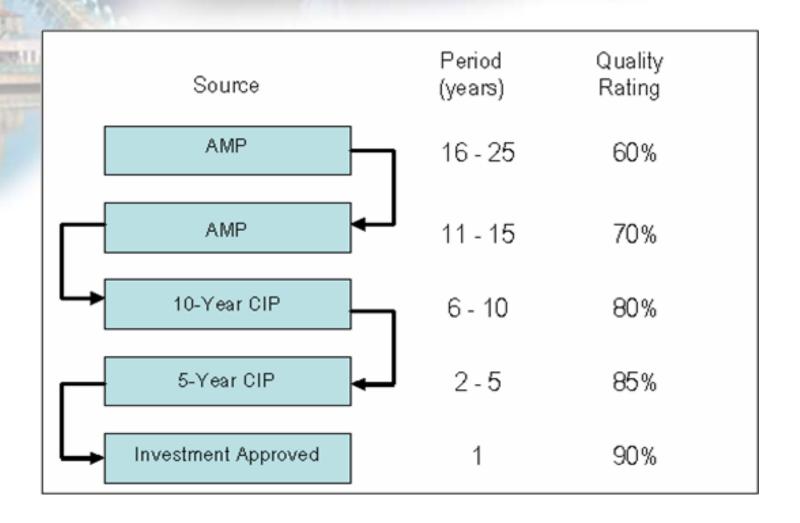


CIP Recommendations

- Better "business case" for projects "Triple Bottom Line" (financial, social, economic impact)
- Clearer understanding :
 - How project affects business risk
 - FMECA and timing of projects
 - Life cycle costs
- More programmatic view of how projects interact

FMECA - Failure mode, effects and criticality analysis

CIP Evaluation Stages



Recall:

60% to 85% of all Life-Cycle Costs are "Locked-In" When Decisions are Made on...

- ✓ Project Identification
- ✓ Strategic CIP Planning

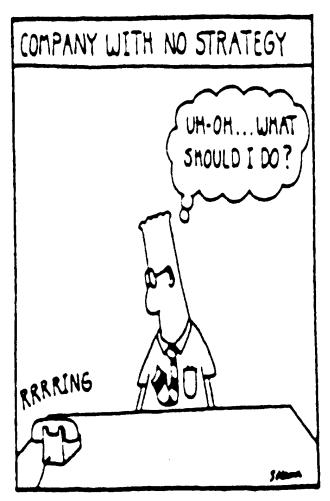
Setting the Scene

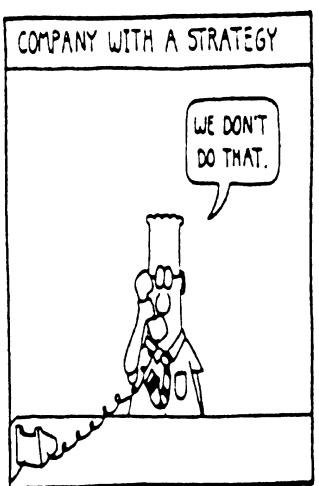
- Now we have the Asset Management Improvement Program running.
- But it will still be sometime before we can get good data ...
- So what can we do now to improve our situation?
- We can start to review and optimize our spending and commence to identify the "lowest life cycle cost" CIP

Key Strategies

- Start your first Asset Management Plan. Build your first system-wide – a "full portfolio" funding model...
- Then optimize the investments we are making now – Use advanced AM techniques to validate and approve your CIP projects & programs.

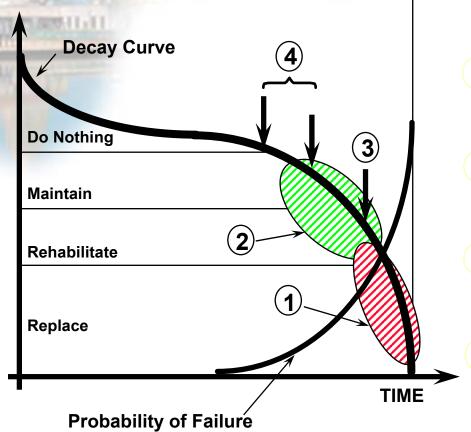
Asset Management Plans





Implementation Priority

CONDITION



Benefit Based Priorities

Priority order

- Assets with a high probability or history of failure (reliability).
- 2 Assets with a high business risk cost (consequence).
- 3 Assets where rehabilitation intervention is beneficial.
- 4 Assets where more appropriate maintenance is beneficial (eg. with high unplanned maintenance).

The Benefits of an Asset Management Plan (AMP)

- Creates linkage between the service level expectations and the asset needs in order to sustain that service.
- Constitutes a consolidated statement of current policies, strategies and programs adopted for the ongoing provision of these services.
- Projects an understanding of the present and future demands on the assets.
- Presents a current estimate of the long term financial commitments necessary to maintain both the assets and the services they provide.
- Depicts a current evaluation of business risks associated with the failure of the assets.

The Benefits of an AMP

- A summary of appropriate strategies to address issues in relation to both the shorter term operations and maintenance and the longer term strategic planning of the assets
- An information source capable of spanning organizational changes and the transfer of responsibilities between successive asset managers
- An ideal tool for the administration of contracts in relation to operations, maintenance and renewals

AMP – Asset Management Plan

The Benefits Of An AMP

- Is a link between business objectives and asset management outputs
- Can model future costs and asset performance with respect to service delivery
- Can identify future work and staffing needs.

Functional Process For Life-cycle Asset Management

Know the physical & functional characteristics of your assets

Determine their current condition & performance on these assets & the systems or facilities of which they form part

Determine an acceptable standard or level of service based on business objectives and customer needs

Determine their likely failure modes and the probable time of failure: capacity, reliability, obsolescence, level of service, structural integrity, cost

Functional Process For Life-cycle Asset Management (cont'd)

Determine the optimal treatment option (ORDM) to overcome the failure mode based on benefit costs judged against organisational needs & risks

Include this work in future asset management plan (AMP)

Review business capability of executing plan

Rationalise plan on risk / needs basis to match available budget (business plan)

RETURN TO START (do not pass go, do not collect \$200)

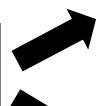
AMP - Typical Table Of Contents

- Introduction And Purpose Of Plan
- Structure And Roles With Respect To Asset Management
- Description Of Assets
- Levels Of Service And Performance Measurements
- Options Analysis For Non Performing Assets
- Financial Forecast And Assessment Of Ability To Fund
- Rationalisation Of Work To Fit Within Available Budget
- Future Improvements Required To Data, Processes Etc

AMP – Asset Management Plan

Asset Management Plans

Asset Management Plans



Predicted Levels of Service

Predicted Cost of Service

Steps In Total Asset Management Planning

1

Identify Current Levels of Service

2

Assess Existing Assets:

- Physical Details
- Condition
- Performance
- Capacity (Current / Ultimate)

3

Predict Demand:

- Capacity / Demands
- Levels of Service
- Performance / Risk

4

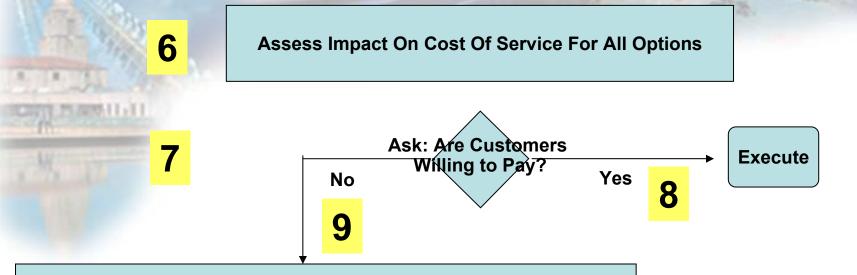
Predict Mode of Failure

- Capacity (Due to Growth)
- Performance / Reliability
- Condition (Age) Integrity
- Cost of Service

5

Examine All Feasible Treatment Alternatives:
New Assets / Renewal / Growth / Efficiency
Improved levels of service
Determine all Technical / Financial Options

Steps In Total Asset Management Planning (Cont'd)



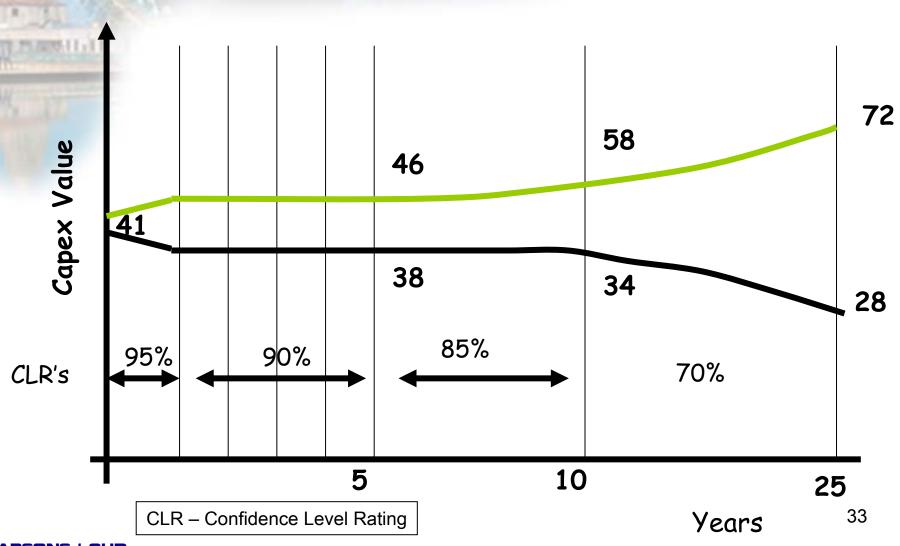
Review program options (reduce cost)

- Reduce levels of service
- Dispose of under-utilized and under-performing assets
- Manage demand for service (pricing, regulation)
- Alter maintenance or operations
- Increase other income sources (grant funds, etc)
- Accept higher residual risk
- Rationalize project work in order of risk

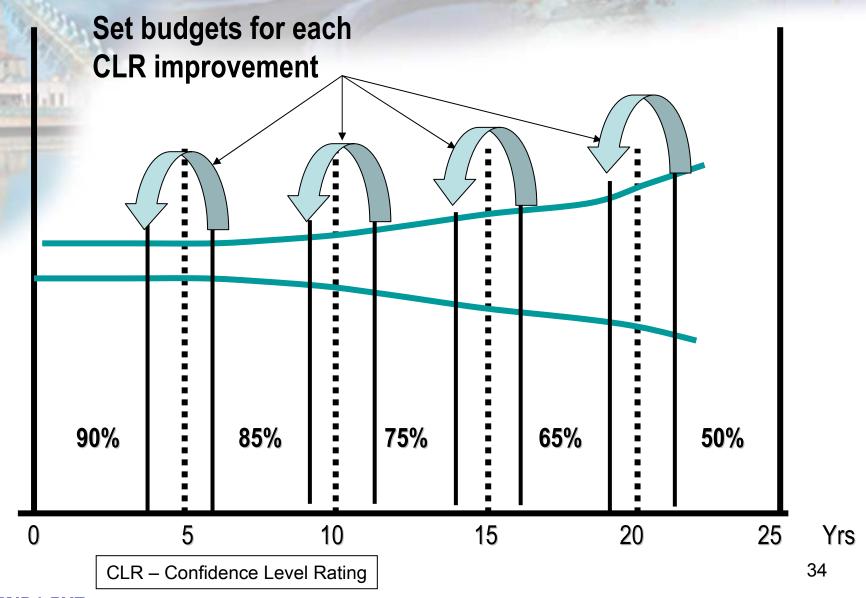
CIP Evaluation Stages

Source	Period (Years)	Quality Rating		
AMP	16- 25	60%		
AMP	11- 15	70%		
10 Yr CIP	6 - 10	80%		
5 Yr CIP	2 - 5	85%		
Investment Approved	1	90%		

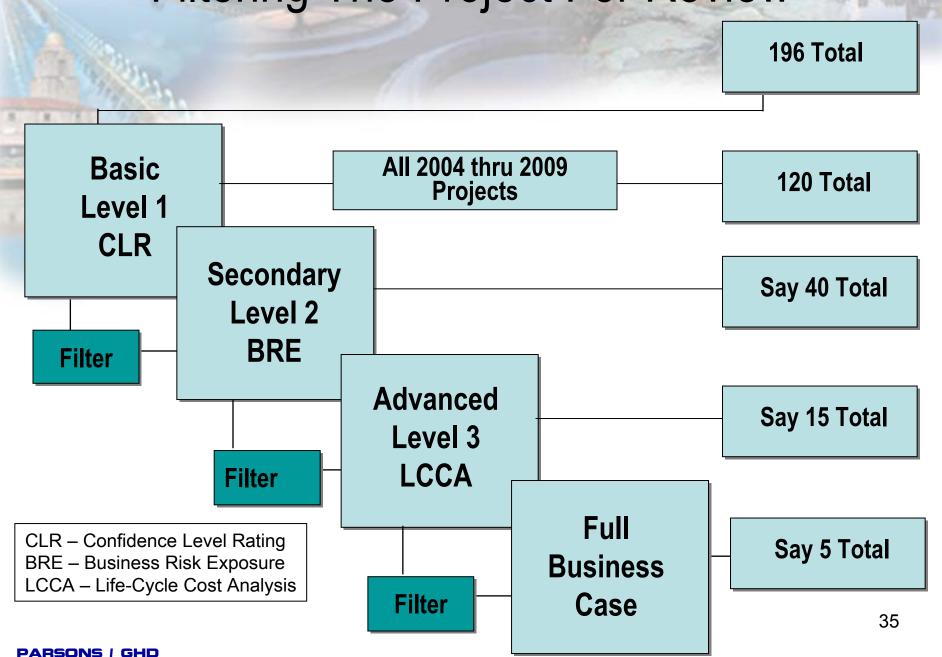
What Should Go in the Funding Model?



Funding the R & D - the Analysis



Filtering The Project For Review



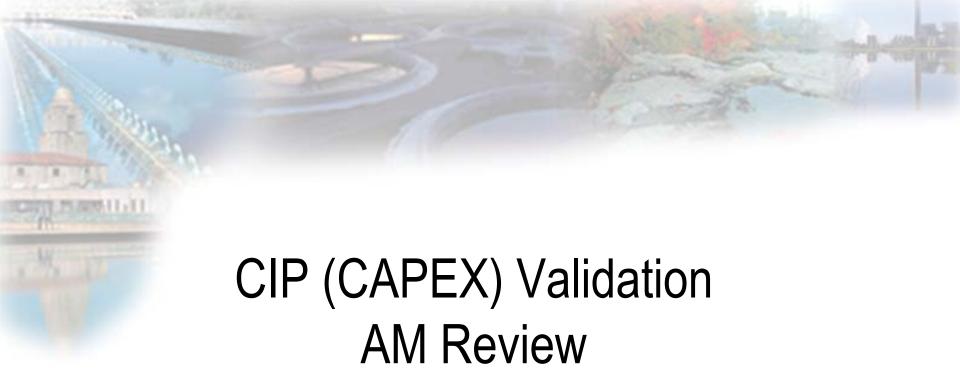
Role of the AM Plan

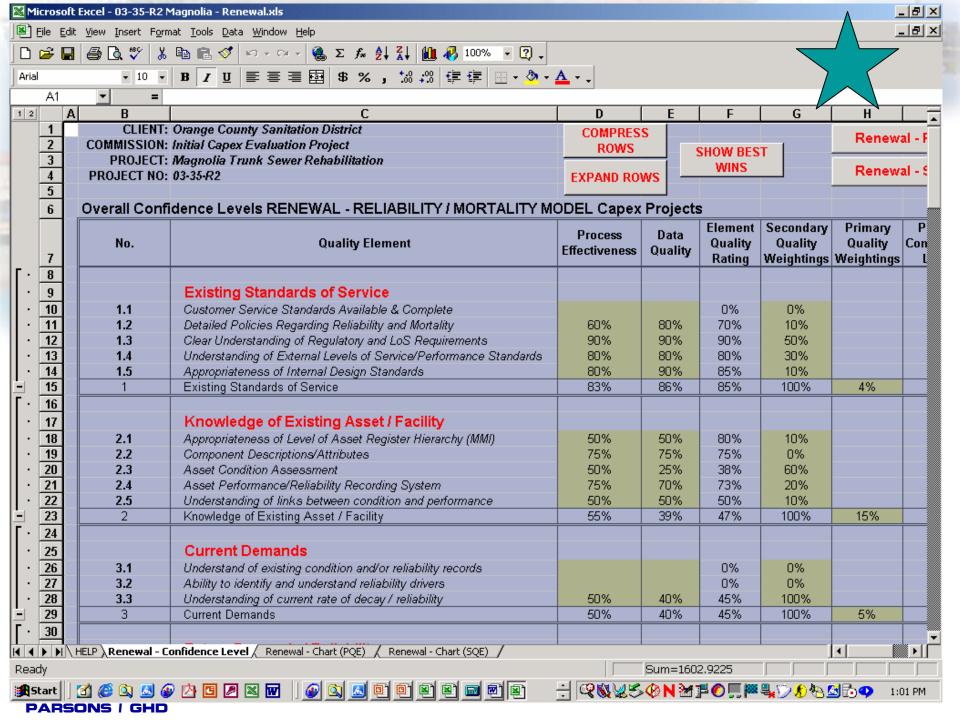


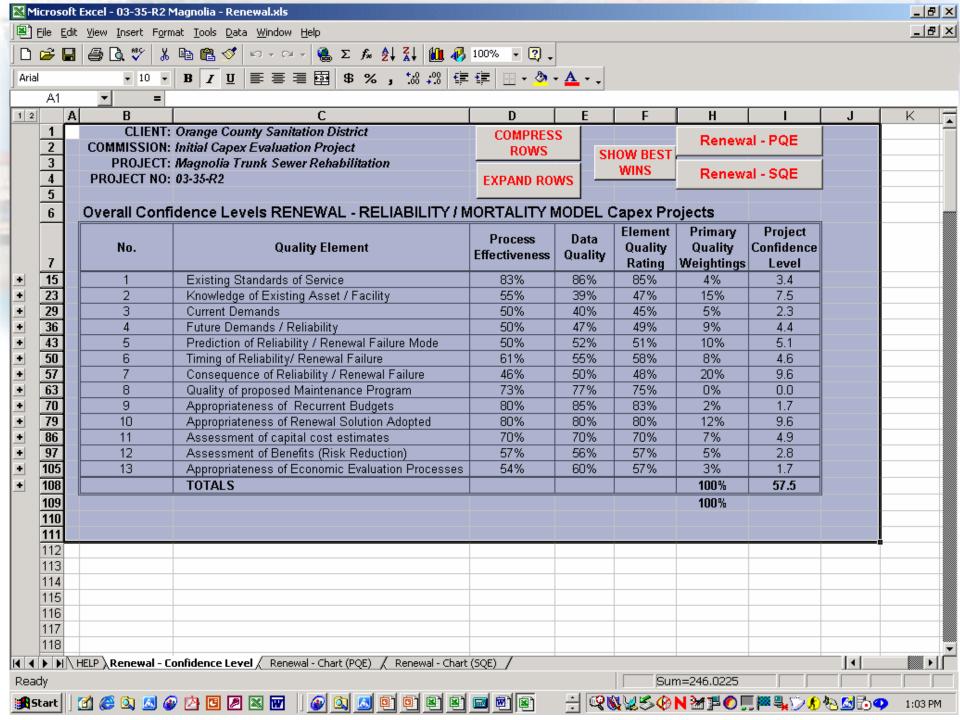
Key Outputs:

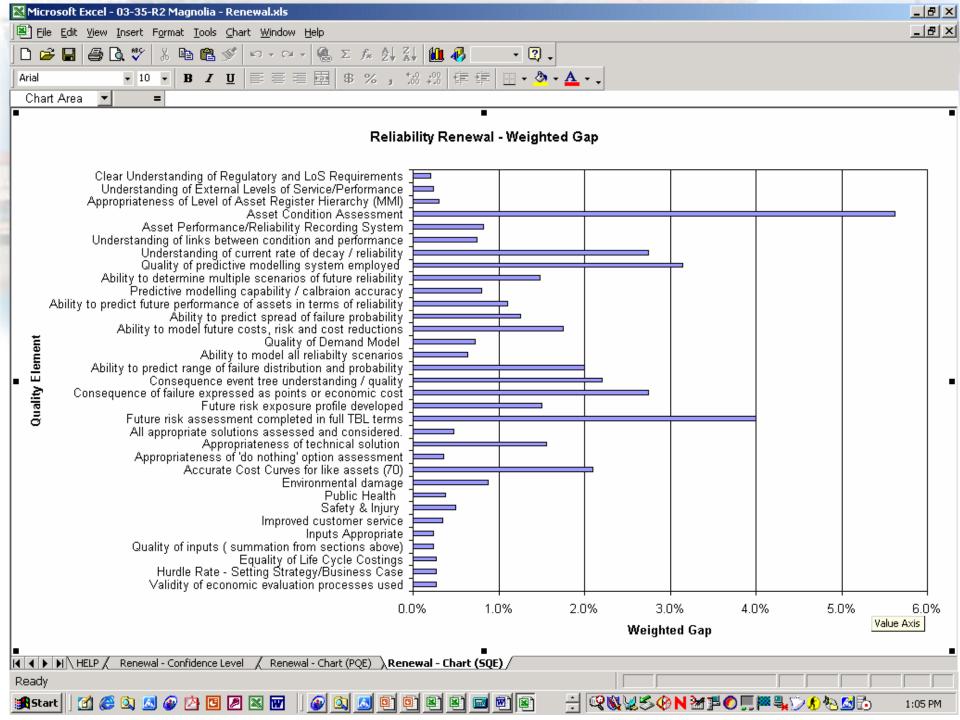
- Costs
- Performance

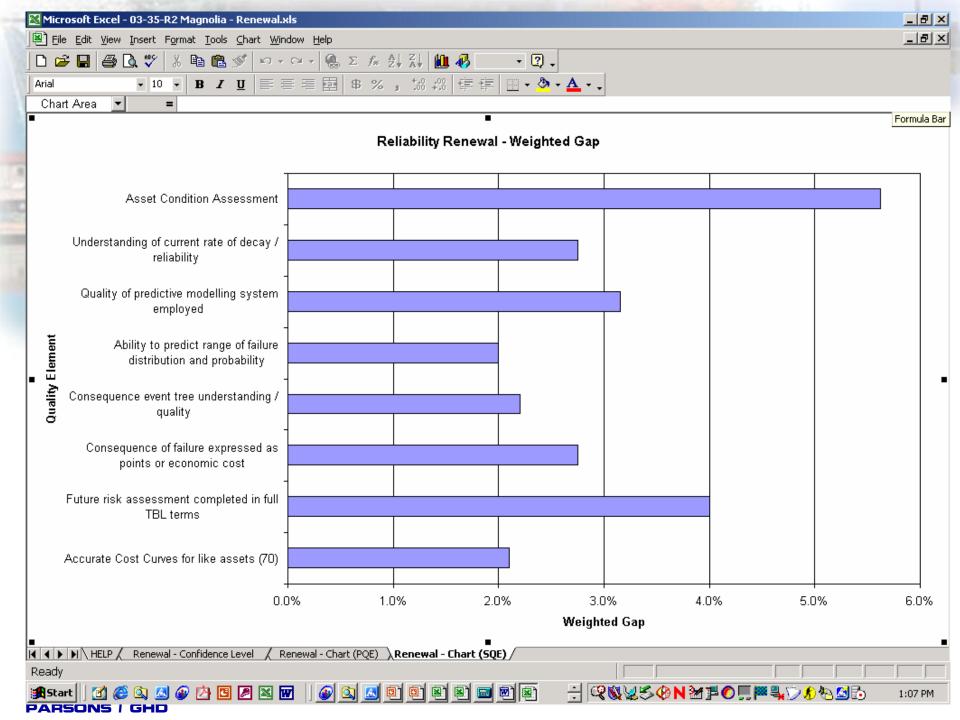
PARSONS / GHD 16c.4











Quality Elements To Be Considered

- 1. Current Standards of Service
- 2. Knowledge of Existing Assets
- 3. Current Asset Demand/Utilisation
- 4. Projected Future Demand/Performance Expectations
- Predicted Modes of Service Delivery Failure

Quality Elements (Cont)

- 6. Timing/Probability of Failure
- 7. Consequence of failure to Business
- 8. Accuracy of Predicted Operational Costs
- 9. Accuracy of Predicted Maintenance Costs
- 10. Appropriateness of Renewal Options

Quality Elements (Cont)

- 11. Accuracy of Cost Estimates
- 12. Appropriateness of Renewal Economic Evaluations
- 13. Relationship Between Plan and Customer Acceptance
- 14. Ability to Modify Plan to Suit Available Resources
- 15. Appropriateness of Plan Action Links to Corporate Goals

AMP - Overall Confidence Levels

Varies for Each
Business

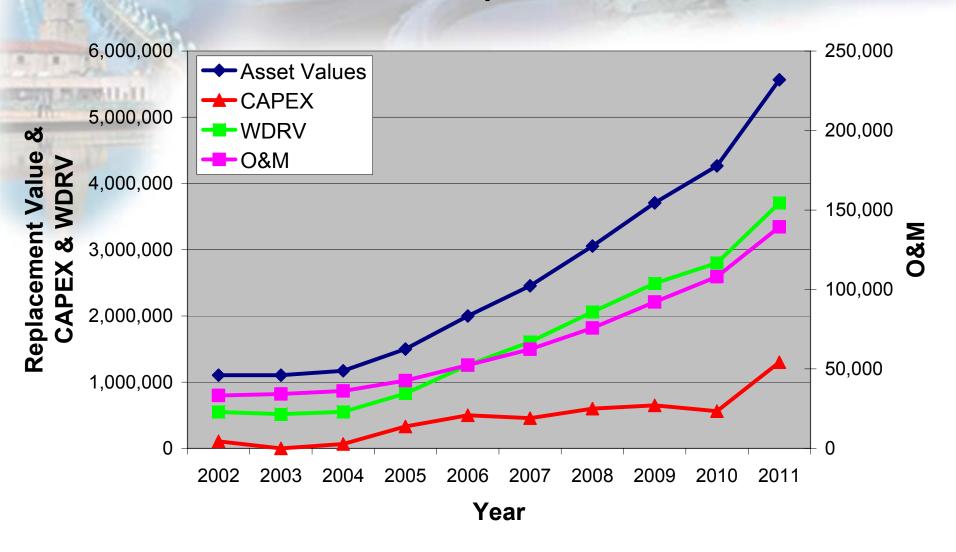


WOMBAT CITY COUNCIL

	Nombat of Football								
1100	Quality Element	Process	Data	Element	Benefits	TAMP			
77,		Effectiveness	Quality	Rating	Weight	Conf.Level			
1	Existing Standards of Service	95%	95%	95%	4	3.8			
2	Knowledge of Assets	80%	80%	80%	12	9.6			
3	Current Demands	100%	98%	99%	4	4.0			
4	Future Demands /LOS	90%	80%	85%	12	10.2			
5	Prediction of Failure Mode	85%	80%	83%	8	6.6			
6	Timing of Failure	85%	70%	78%	6	4.7			
7	Consequence of Failure	75%	60%	68%	10	6.8			
8	Quality of proposed Maintenance Program	75%	60%	68%	15	10.1			
9	Appropriateness of Oper. & Maint. Costs	95%	85%	90%	6	5.4			
10	Appropriateness of Renewal Options	80%	80%	80%	4	3.2			
11	Appropriateness of New Asset Options	95%	85%	90%	4	3.6			
12	Appropriateness of Capital Evaluation Processes	80%	80%	80%	6	4.8			
13	Plan & Customer Expectations	85%	85%	85%	5	4.3			
14	Ability to Modify Plan	75%	80%	78%	2	1.6			
15	Links to Business Goals	85%	80%	83%	2	1.7			
	TOTALS				100%	80.1			

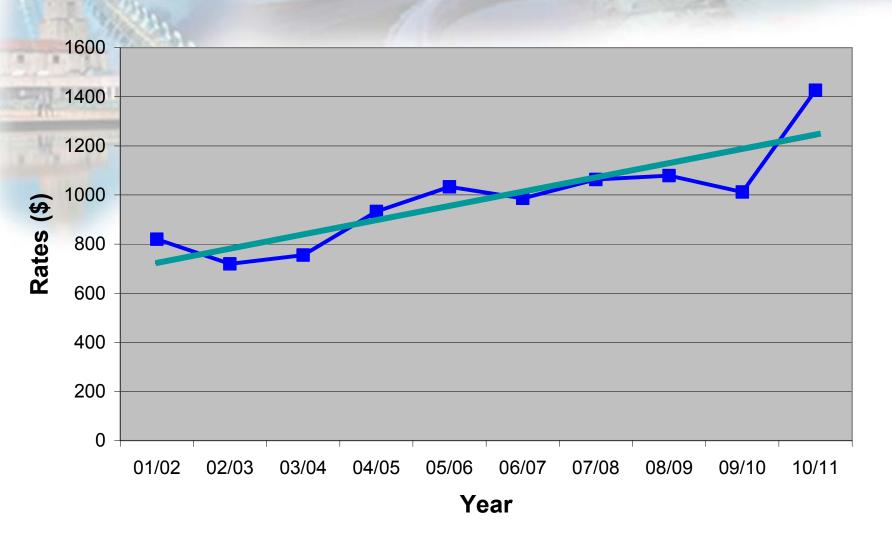
Long Term Funding Requirements

Asset Expenditure



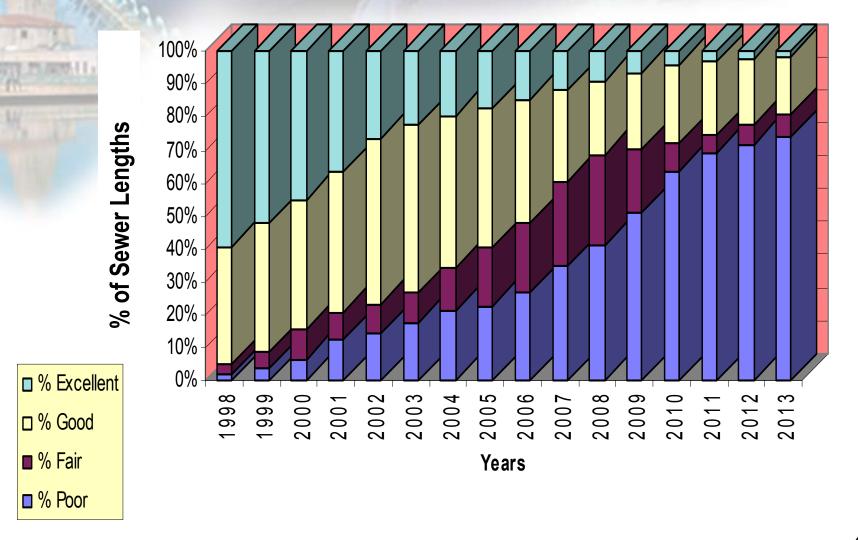
Long Term Impact on Rates

Rates with Time



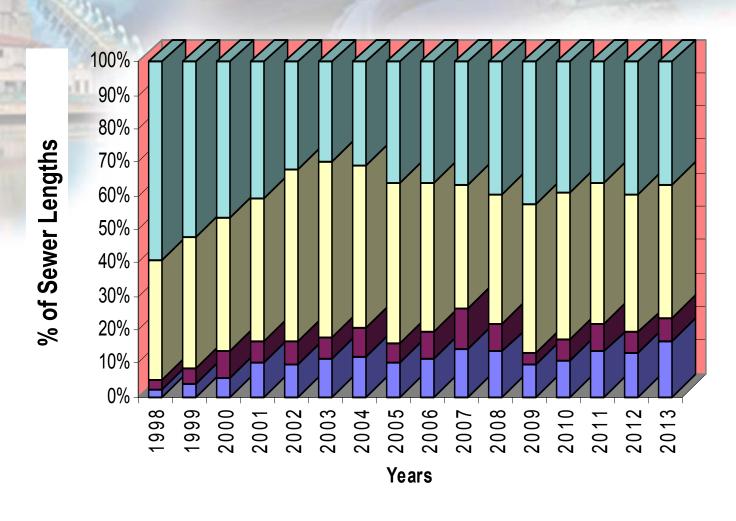
Sewer System - Status Quo

Scenario 0 - Based on PCI Values



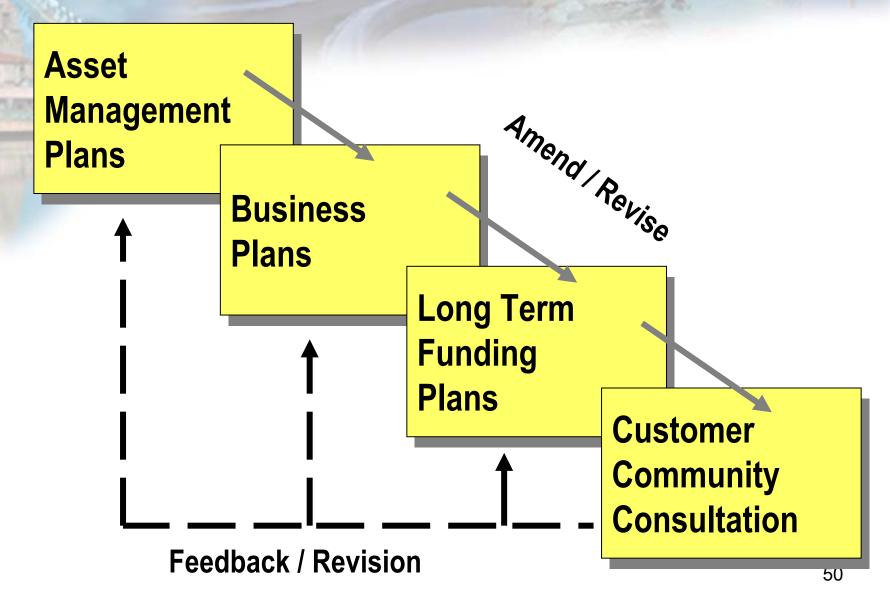
Sewer System - Optimal Strategy

Scenario 4 - Based on PCI Values





The Key Products / Outputs



Key Benefits of Advanced CIP Validation

Defer capital works

Reduce scope or size of works

Reduce unjustified redundancy

Reduce operations

Reduce maintenance

Meet operating requirements

Key Benefits

Exercise Number 8

Using the information you have heard in this session, what are the steps you would recommend to Tom to get the program spread over the whole of the Agency?

Break into your groups and develop a list of what you would recommend ..

One group will be asked to present to the participants ..

Key Lessons Learned

- Complete a similar process for all your assets.
- Do it with the best data you have.
- ⇒ Construct your first AM plan following this process.
- ⇒ Build the Capital Improvement Plan.
- ⇒ Add allowances for O&M.
- ⇒ Build your initial funding plan.
- □ Understand its impact on your rates.
- ⇒ Decide on a strategy to sell / market the needs.

Take Home Messages

- Start your asset management plans as soon as possible...
- Don't wait .. Get started now ..
- Don't worry about quality (confidence level) but just keep going
- Understand the biggest weaknesses
- Improve those next year ..
- Follow the continuous improvement proposition...

AGENDA

Day 2

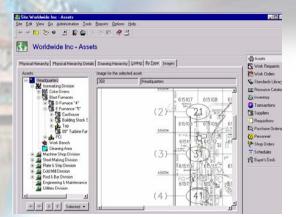
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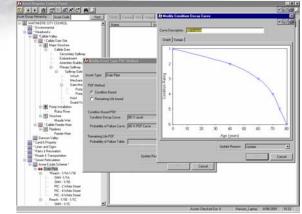
IT Systems – 4 Core EAMS Components



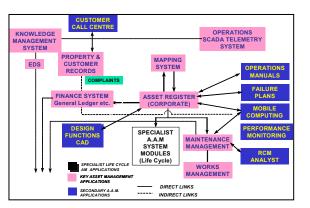
1. Data Standards/Asset Hierarchy



4. Knowledge Management



2. Work Processes/"Best Practices"



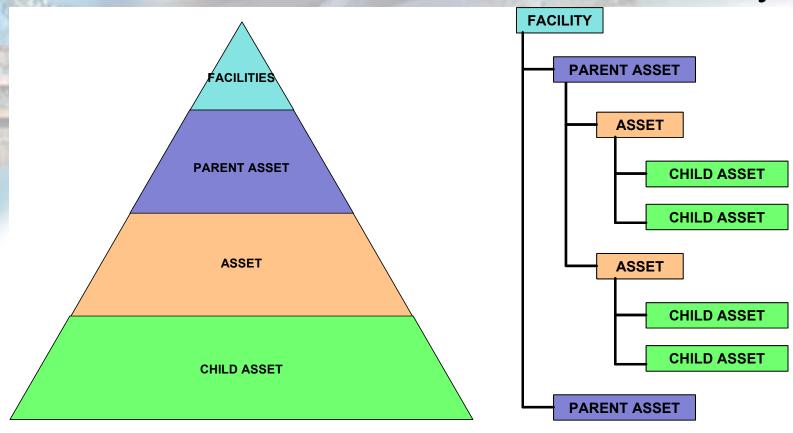
3. Architecture/Integration of Tools

Robust Enterprise Asset Management System – Enterprise-Wide EAM Functionality

A Vision of IT Best Practice – The Starting Point

- "We monitor the condition, performance, utilization, and costs of assets down to the Managed Maintenance Item component level (as justified) and aggregate this data up to give outputs of cost and performance at:
 - asset
 - facility
 - sub system or
 - full system / program level"

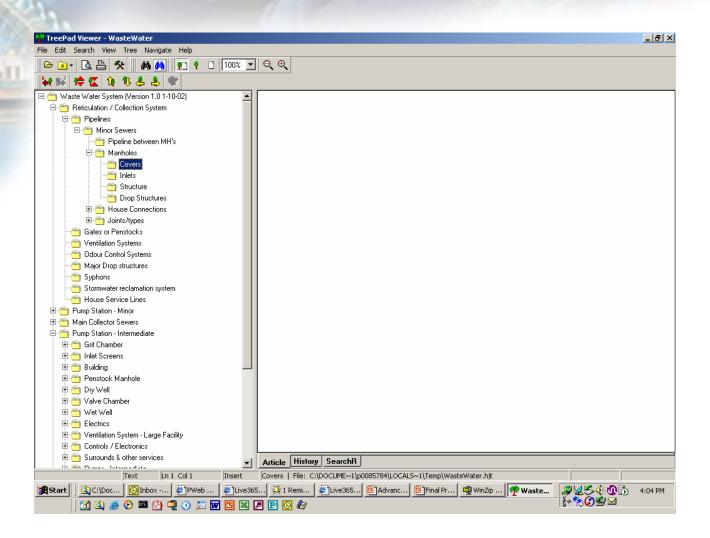
1. Data Standards and Asset Hierarchy



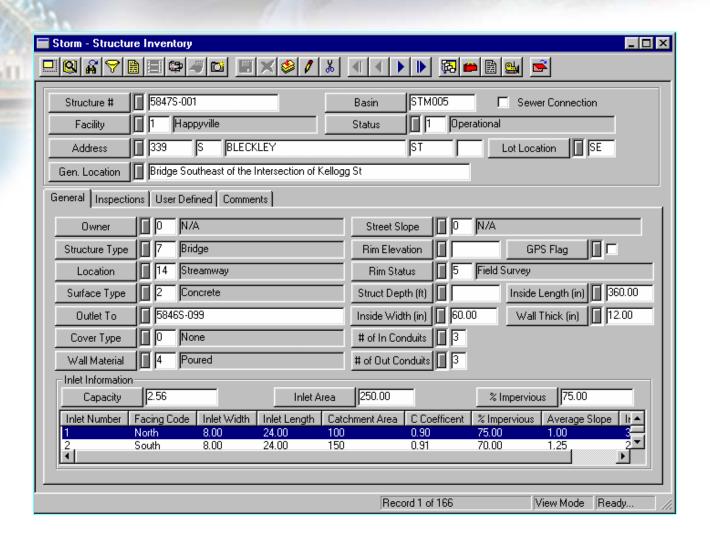
An agency's data standards are the backbone of its management capabilities:

if we don't know what we have, where it is, and what condition it is in, we can't really be managing it.

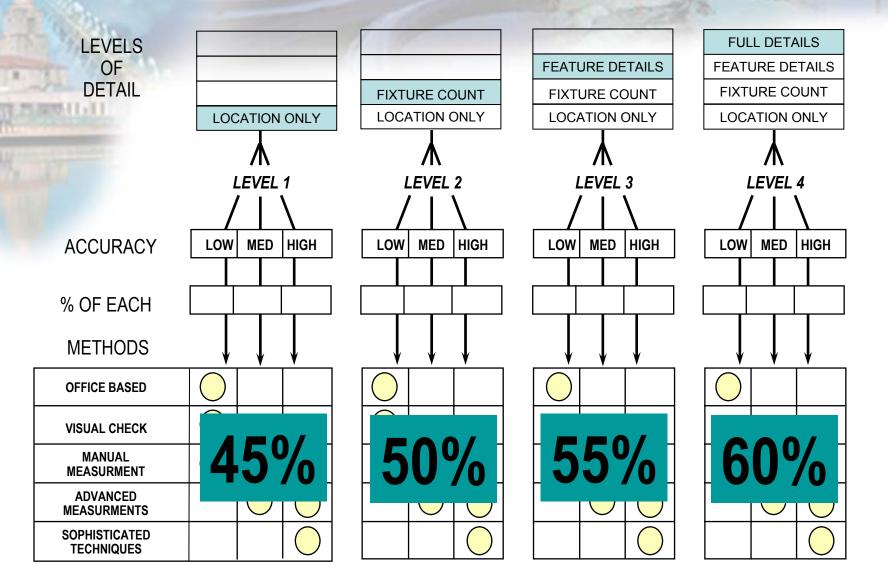
1. Data Standards and Asset Hierarchy



1. Data Standards and Asset Hierarchy



Data Collection - Levels of Detail



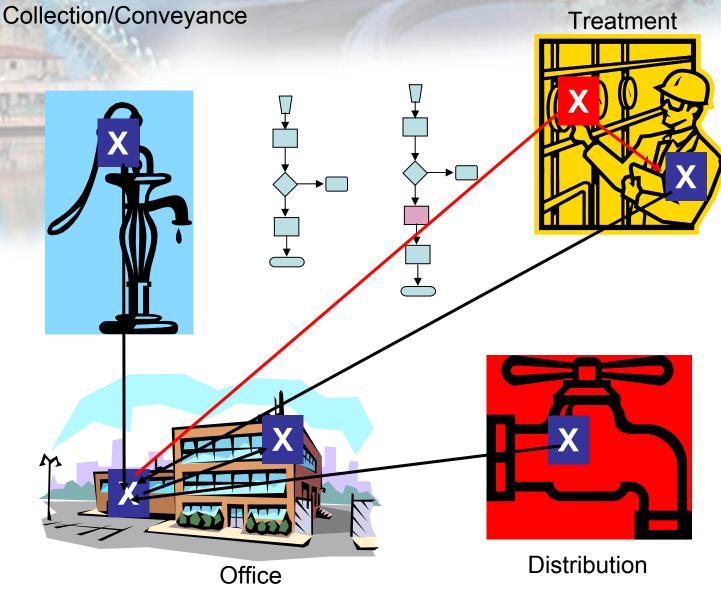
Rolling up Confidence



Confidence at higher system levels is determined by MMI component accuracy.

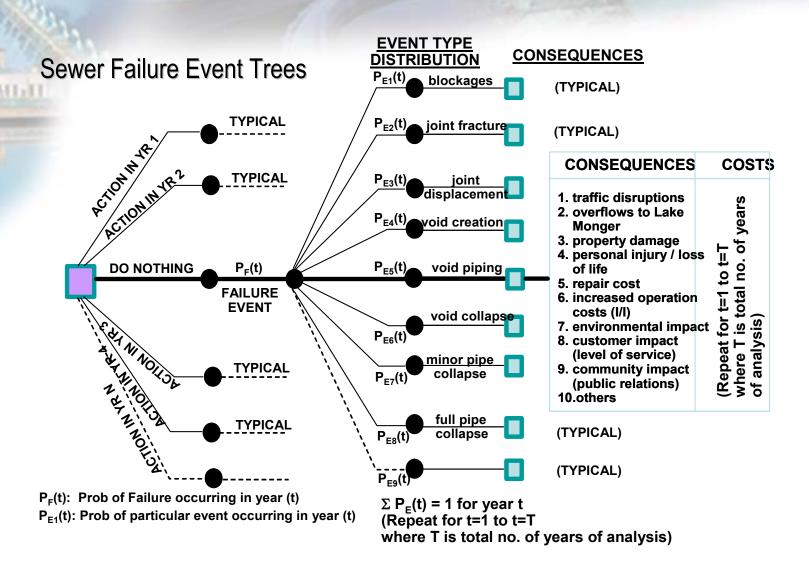
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2. Work Processes + "Best Practices"

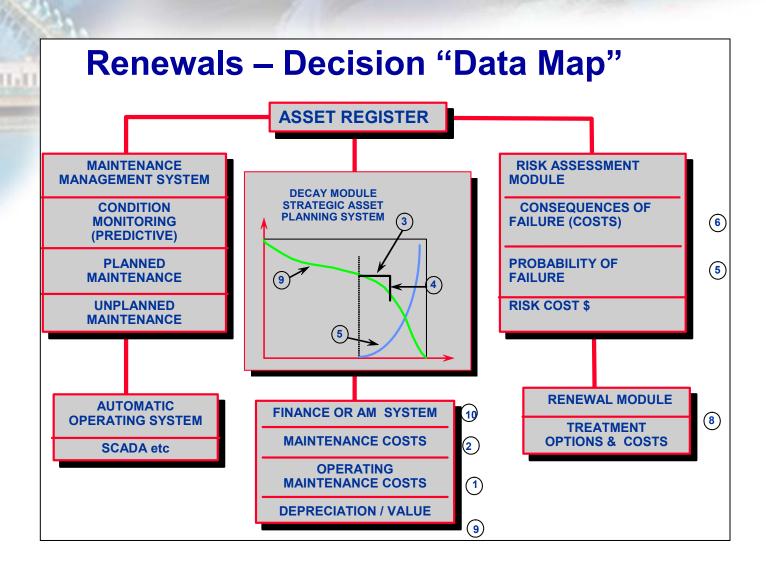


Who?
What?
When?
"Best
Practice"
work
processes
should drive
system
functionality

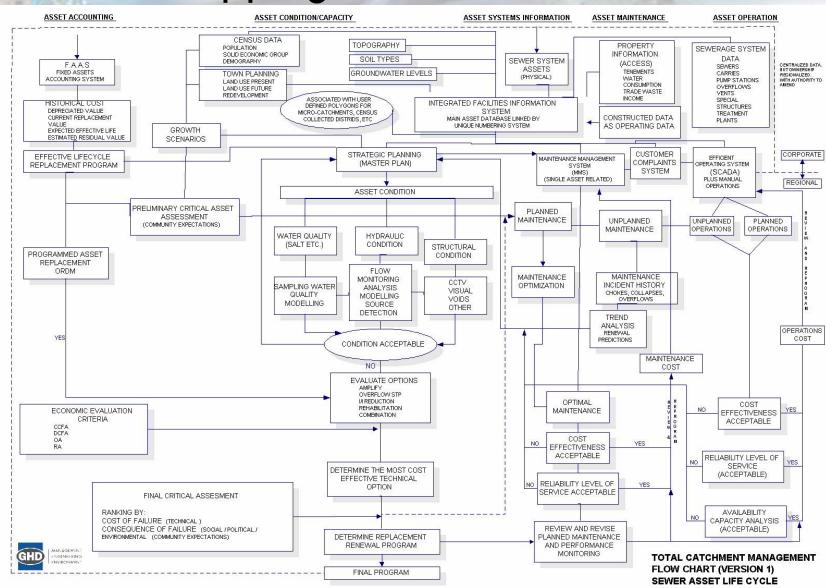
2. Work Processes + "Best Practices"



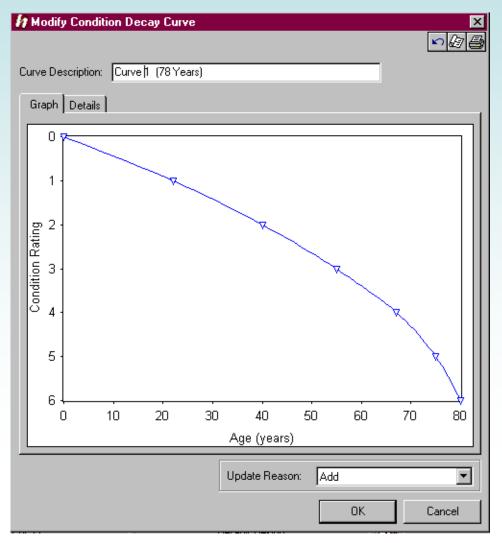
2. Work Processes + "Best Practices"



Mapping the Work Process



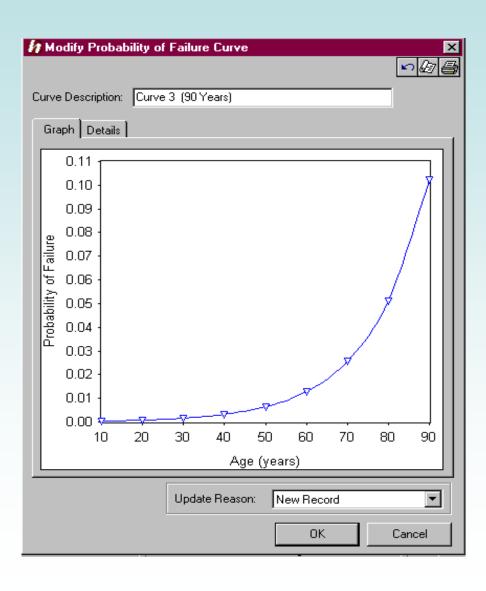
AssetLife



Risk
Management Definable Decay
Curves



AssetLife



Risk Management Definable
Probability of
Failure Curves





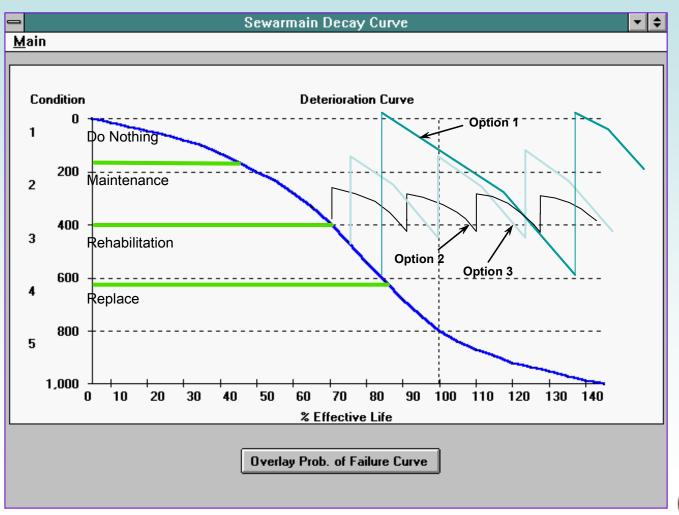
Risk Management - Multi-Trial Risk Analysis

🏿 Risk Analysis - SS0000	004 Reacl	h - 1/1A-1	1/1B *		X				
					∞ 🔄 🎒				
Highest Risk Failure Mode:									
	07/08/2000								
Cause of Failure:		1							
Cause of Fallule.									
[_								
Remaining Life:	25								
	▼ Use R	emaining Li	ife from Costing						
	Weight	Area	Trial 1	Trial 2	Add Trial				
Failure Mode			Remaining Life	Root Penetration ▼ Str					
					D <u>e</u> lete Trial				
Cost of Repairs	30.00	1.00	2 - Costs less than \$10,000 ▼	2 - Costs less than \$10,000 ▼					
Damage to 3rd Party	20.00	1.00	2 - Liability less than \$10,000 ▼	6 - Liability between \$500,00 ▼					
Environmental Damage	10.00 40.00	1.00 1.00	0 - None 20 - Loss of 1-2 lives	0 - None					
Loss of Life	40.00	1.00	20 - Loss or 1-2 lives	200 - Loss or more than 10 live 🔻					
Total C.o.F.			900.0000	8180.0000					
Unit Cost Multiplier			1.00	1.00					
Calc. Probability of Failure			0.0200	0.3000					
No. of Redundancies			1	1					
Redundancy Factor			1.0000	0.5000					
Actual Probability of Failure			0.0200	0.1500					
Risk			18.0000	1227.0000					
 									
<u>D</u> elete OK Cancel									



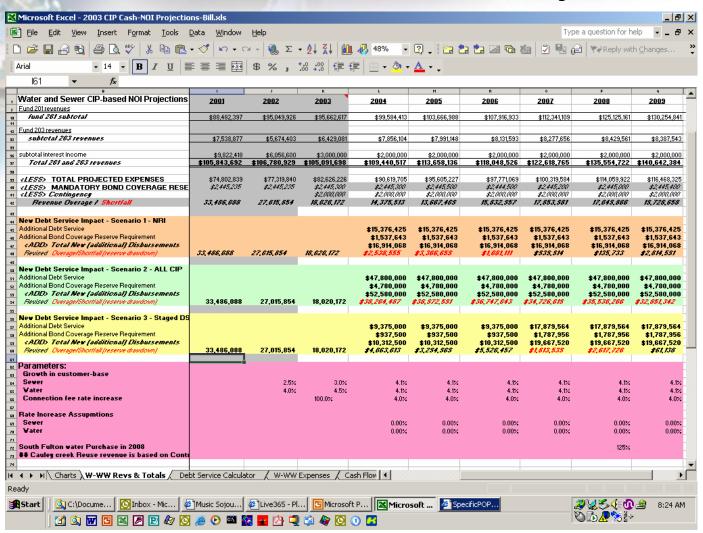
AssetLife

Risk Management - Multi-Trial Risk Analysis





NOI/Cash Generation Projections

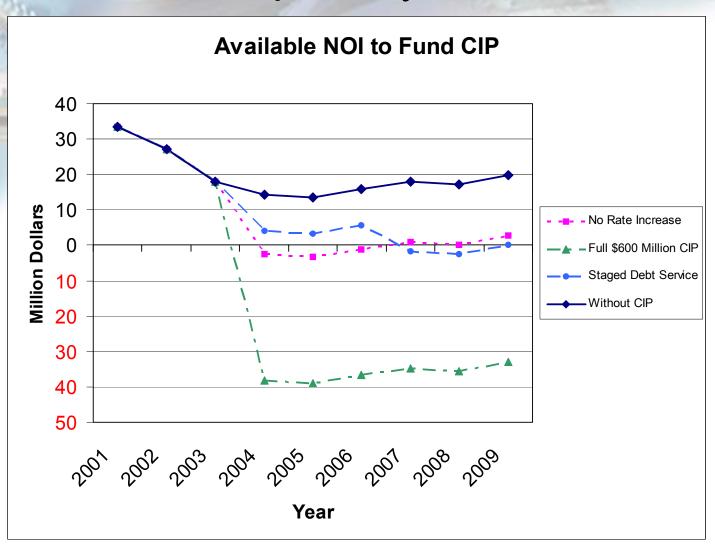


Alternative Funding Scenarios

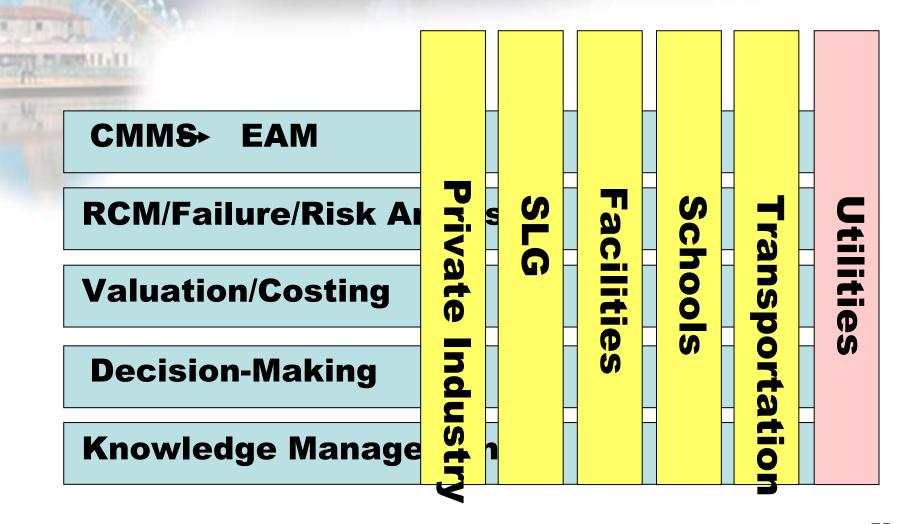
Scenario	Gross Bond Amount (millions)	Net Bond Proceeds (millions)	Annual Debt Service (millions)	Notes
1. No rate increase	\$215.0	\$193.5	\$15.4	Current 201/203 available cash balances pay for current 203 projects for all scenarios
2. Fund all \$600 million initially	\$668.4	\$601.5	\$47.8	30 to 35% immediate rate increase
3. Staged Debt Service	\$250.0	\$225.0	\$9.4 \$17.9	3 years of interest only
4. "Just in time" capacity, obligations	\$230.0	\$207.0	\$8.6 \$16.5	3 years of interest only; meets "bottom line" capacity requirements and commitments

Bond assumptions: 20 year term, semi-annual payments, 3.75% rate, 10% cost-to-issue, initial payment in June 2004

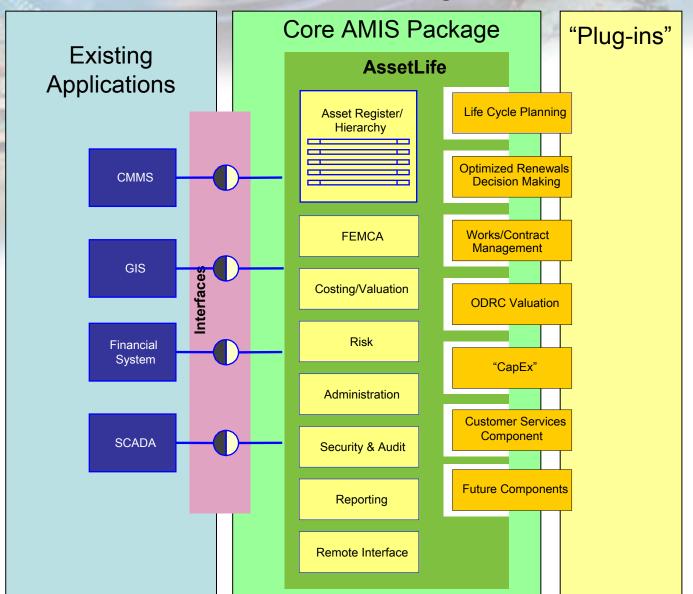
Cash Impact By Scenario



3. Architecture/Integration of Tools

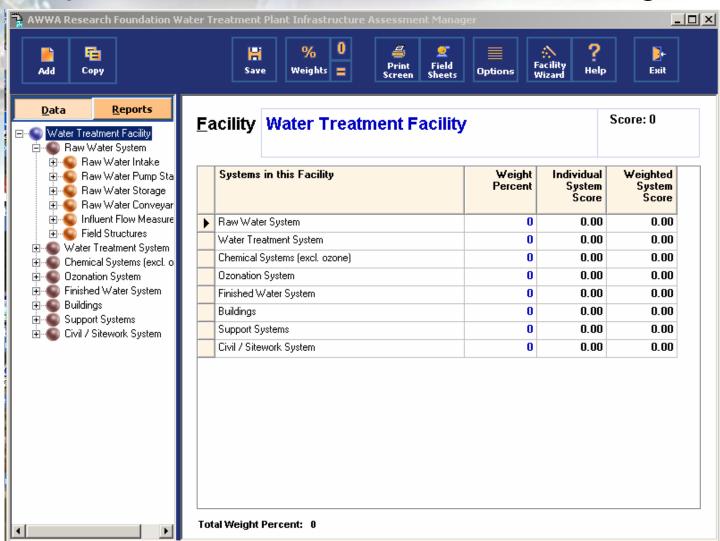


3. Architecture/Integration of Tools

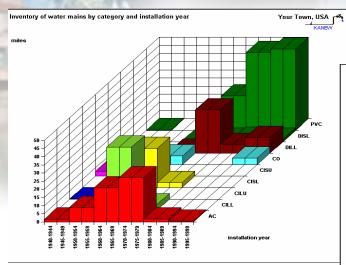


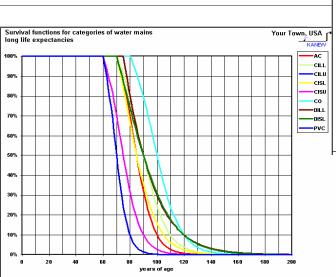
Most
agencies
find it
much
more costeffective to
build on
existing
platforms,
step-bystep.

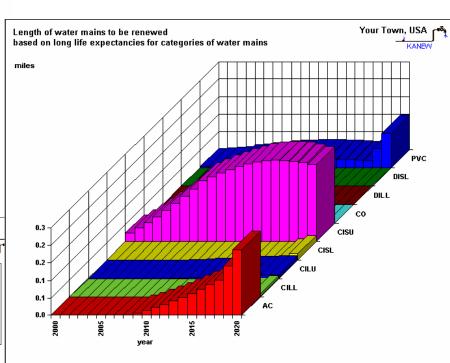
Plug-In Applications May Be Relatively Inexpensive – AWWA's "Plant Manager"



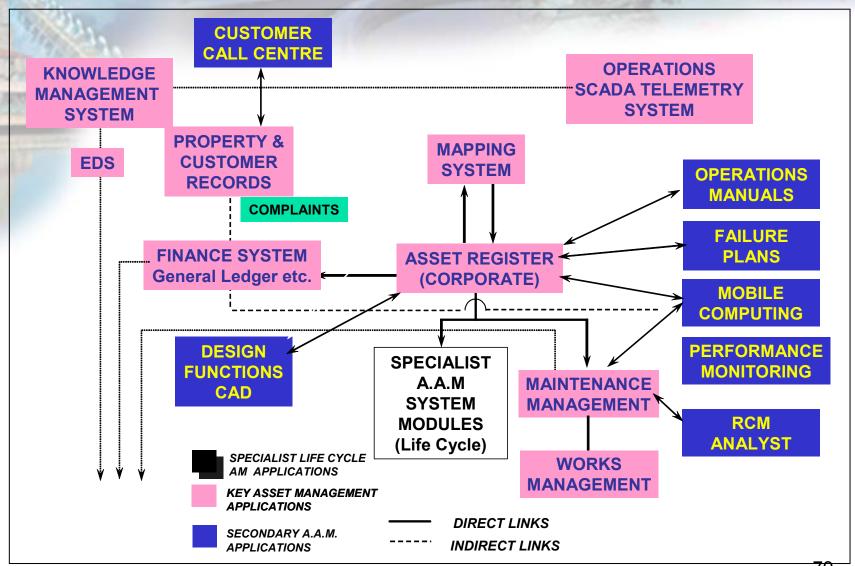
Plug-In Applications May Be Relatively Inexpensive – AWWA's "Kanew"



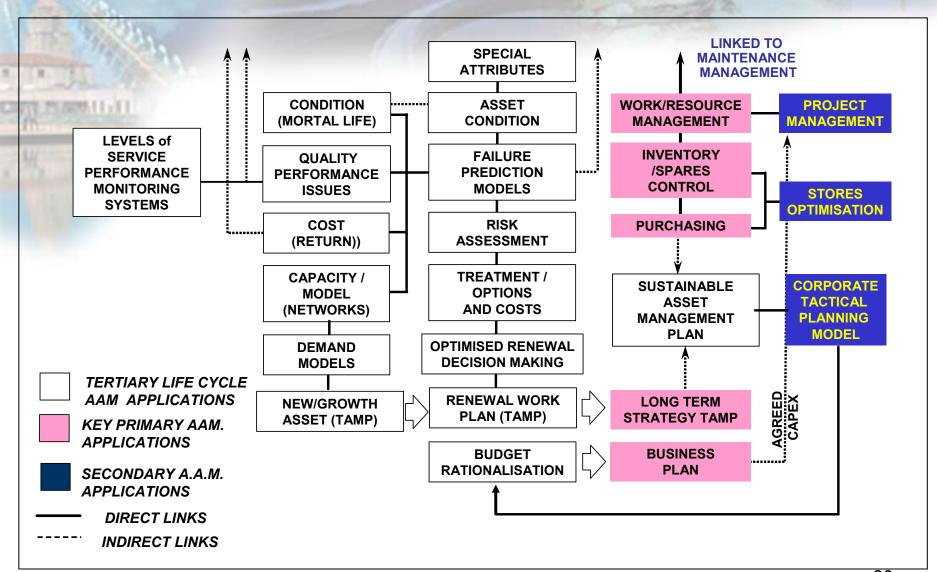




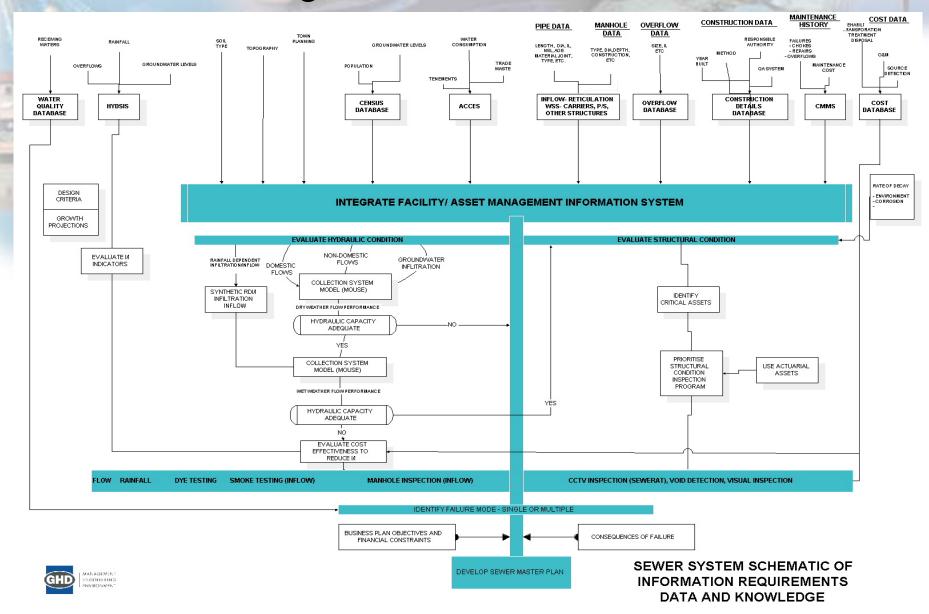
Idealized Model of Integrated Functionality



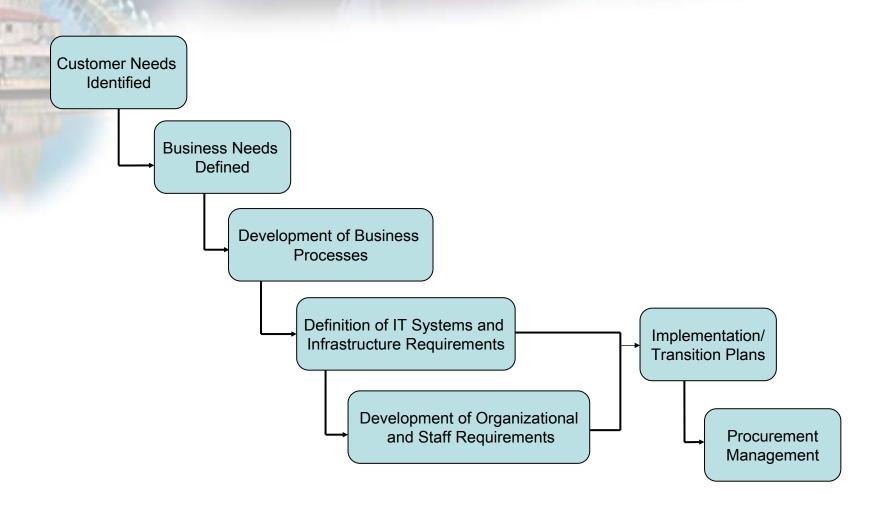
Idealized Model of Integrated Functionality



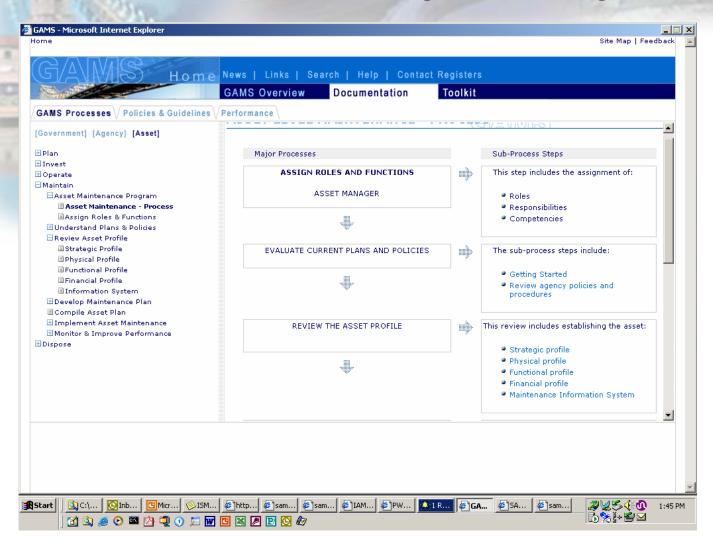
Dataflow Diagrams - Work Process + Data



The System Design/Integration Process

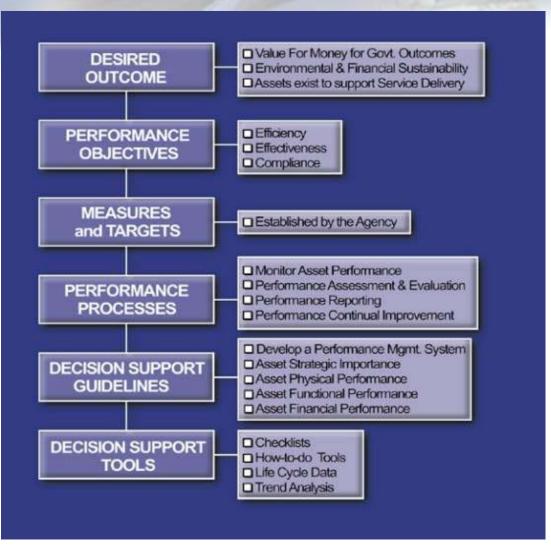


4. Knowledge Management

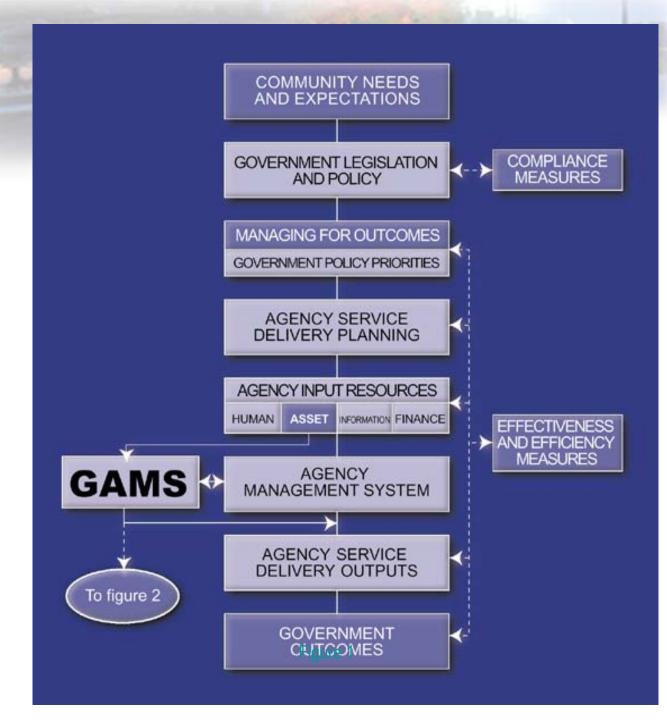


Bedding down
EAM work
processes in
the
organization is
critical to
sustaining long
term
improvements

4. Knowledge Management

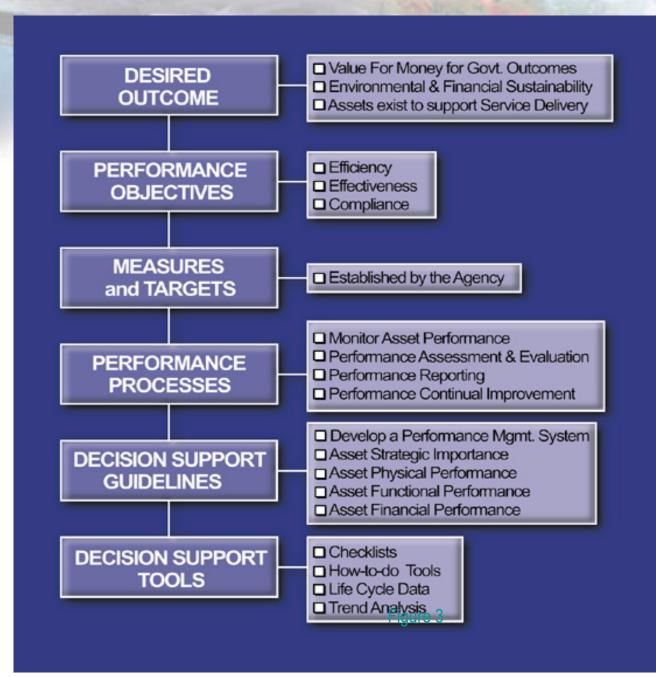


"MANAGIN ZΣ **₩** (5)

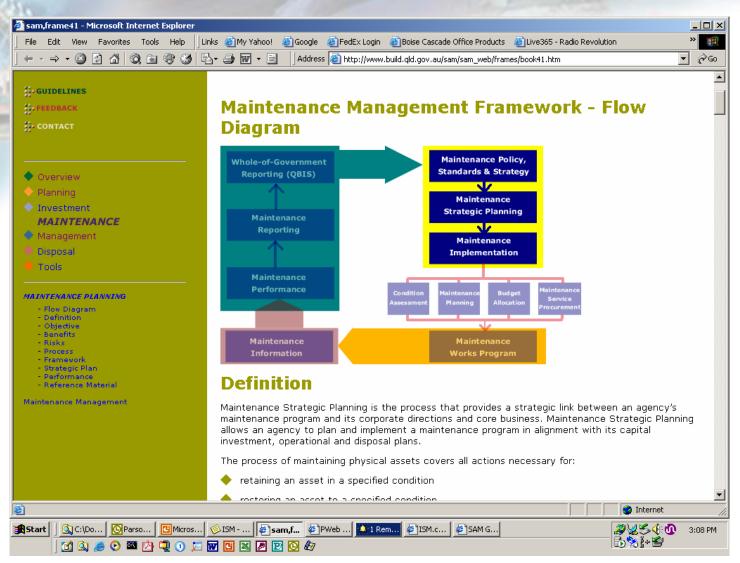


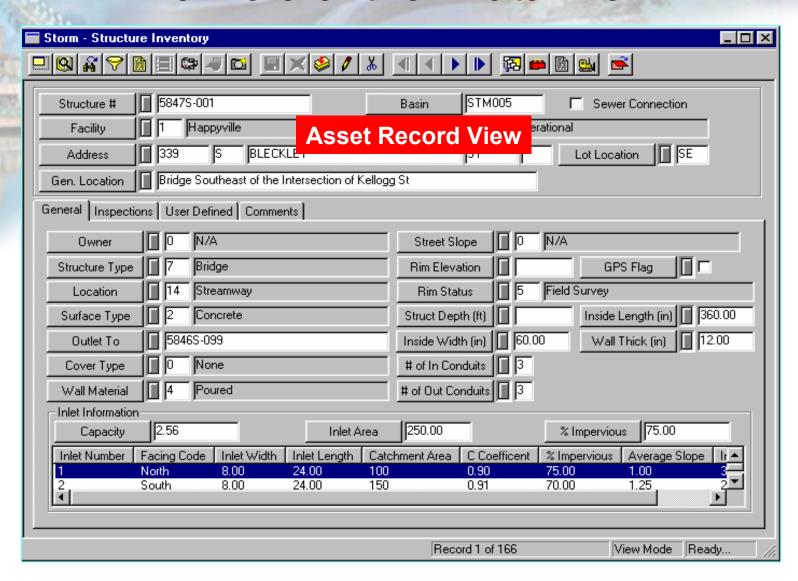
ASSET MANAGEMENT LEVELS ☐ Whole-of-government (or Corporate) Level □ Agency (or Portfolio) Level ☐ Asset (or Facility) Level ASSET LIFE CYCLE PHASES **GAMS** ☐ Strategic Planning Phase PERFORMANCE Investment (or Refurbishment) Phase MANAGEMENT **FRAMEWORK** Operations & Maintenance Phase Disposal Phase ASSET MANAGEMENT CLASSES To Figure 3 Land assets **Built Assets** Infrastructure Assets Plant and Equipment Assets

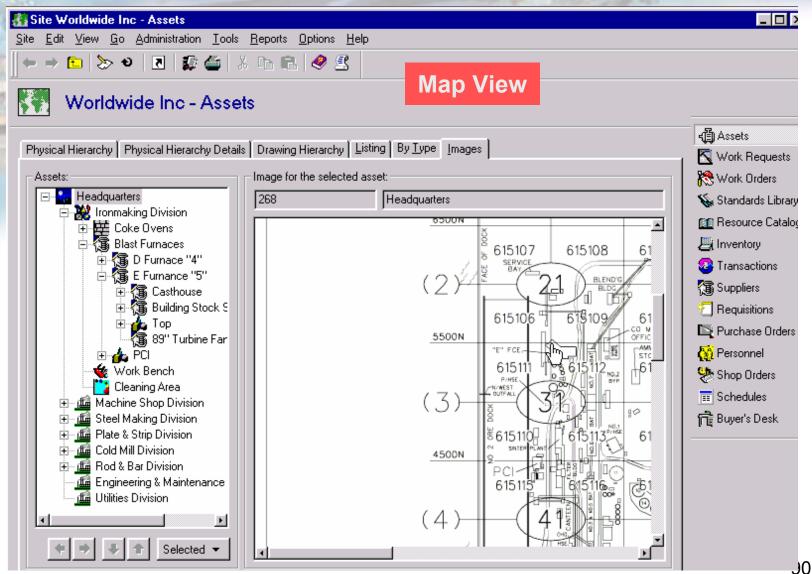
RAMEWO GAMS PERF MANAGEMENT

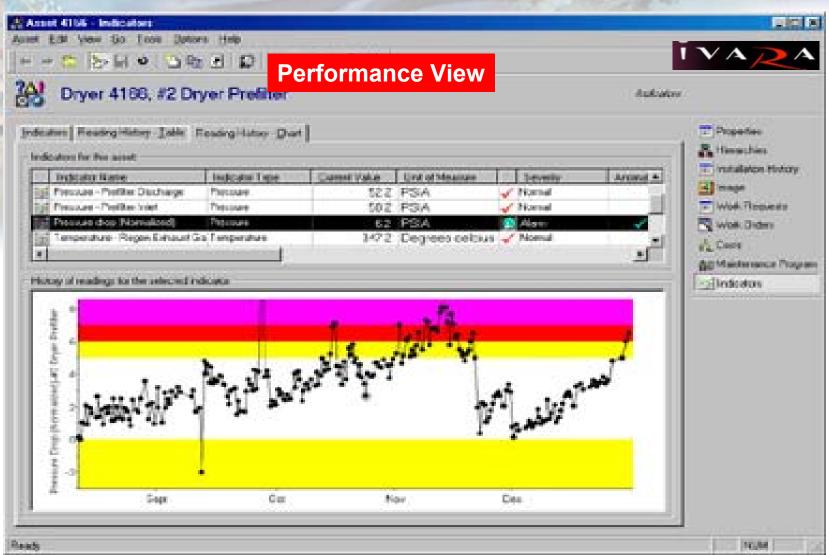


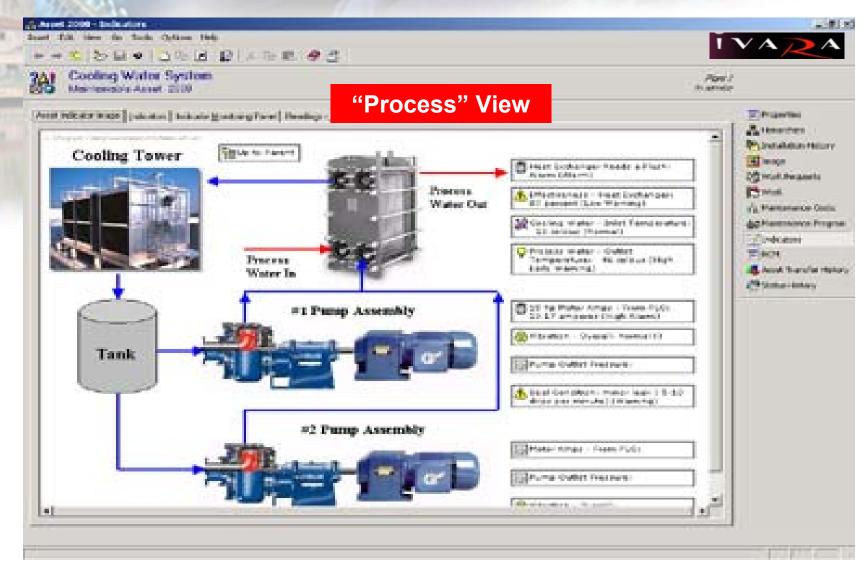
4. Knowledge Management

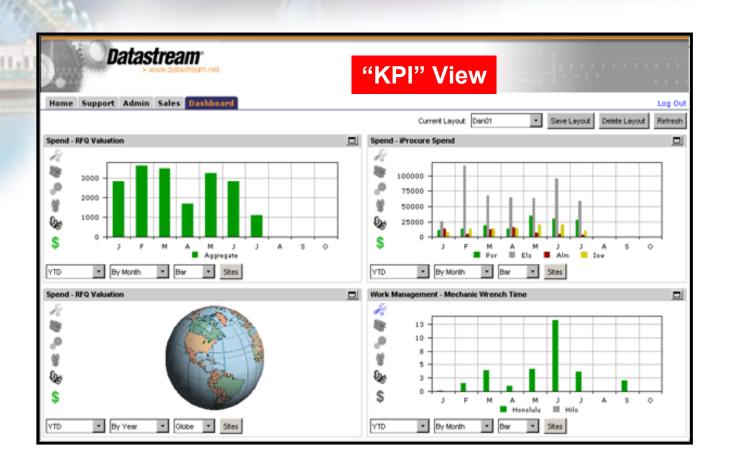


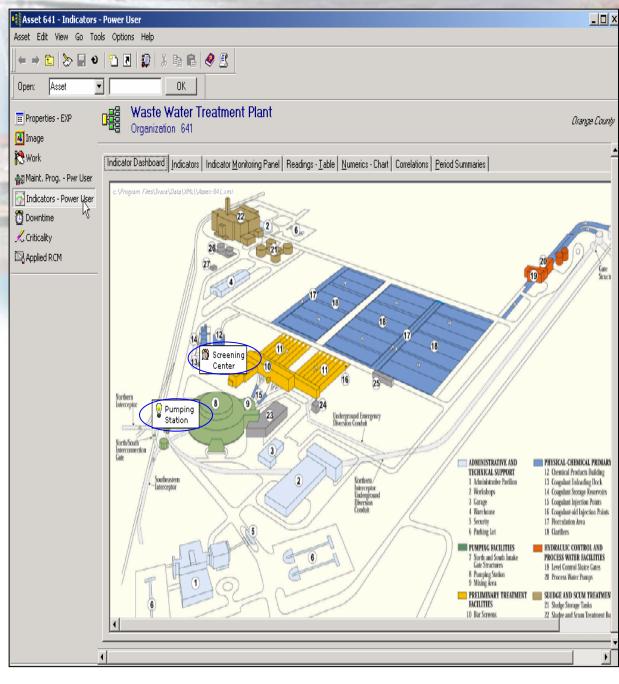






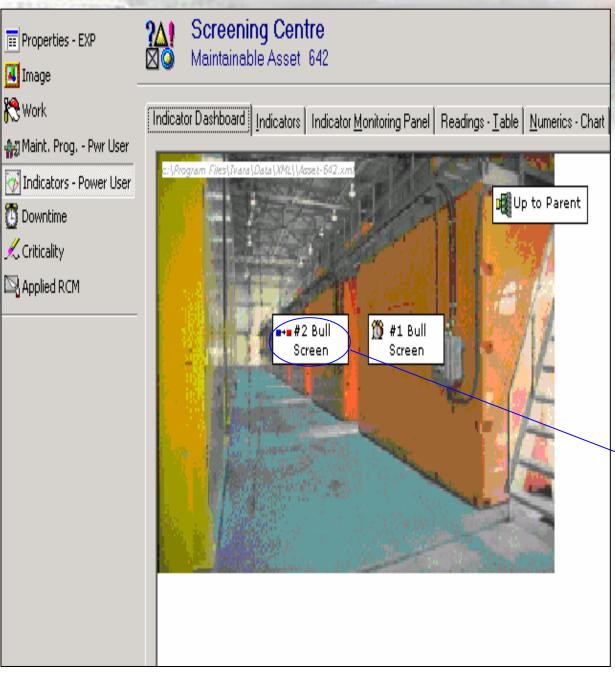






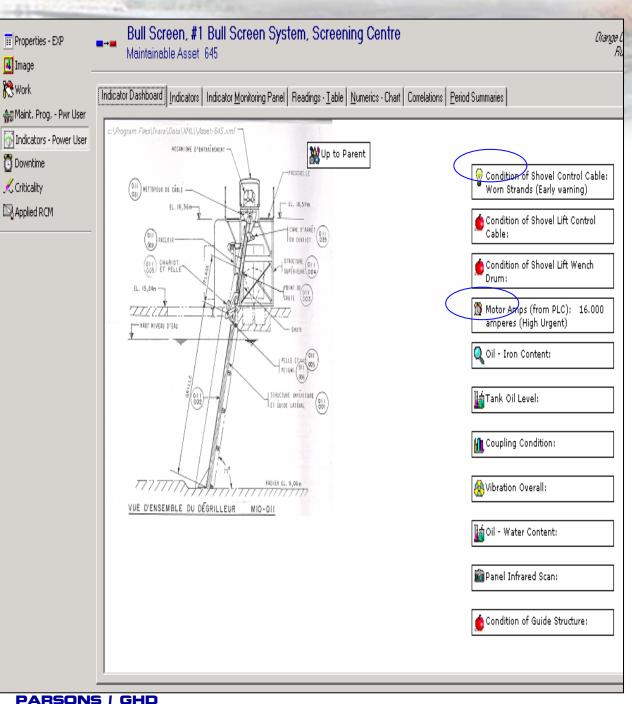
Navigation by Images

- Click on the hotlinks to drill in.
- Icons (blinking) show highest alarm on each hotlinked asset
- Easy to use/understand



Navigation by Images

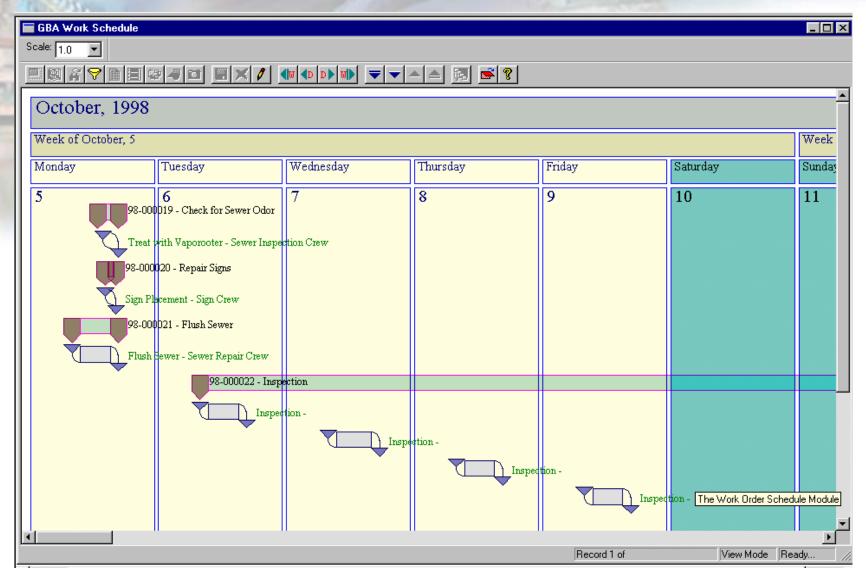
- Down one level at the Screening Center
- More hotlinks to child assets
- Blinking icons for assets in alarm condition



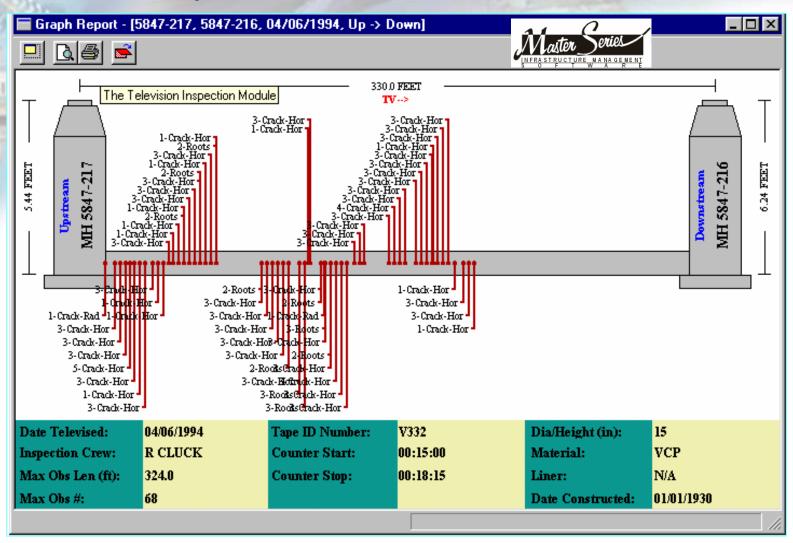
Navigation by Images

- One more level down
- Number of levels not restricted
- Key indicator dashboard on critical assets
- Blinking icons show severity, words show condition
- Interactive links (right mouse click)

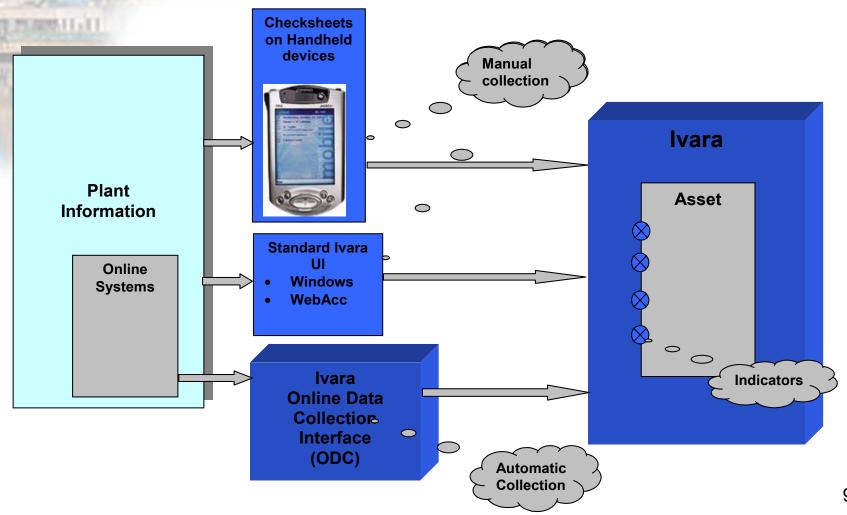
Friendly Work Process Interface



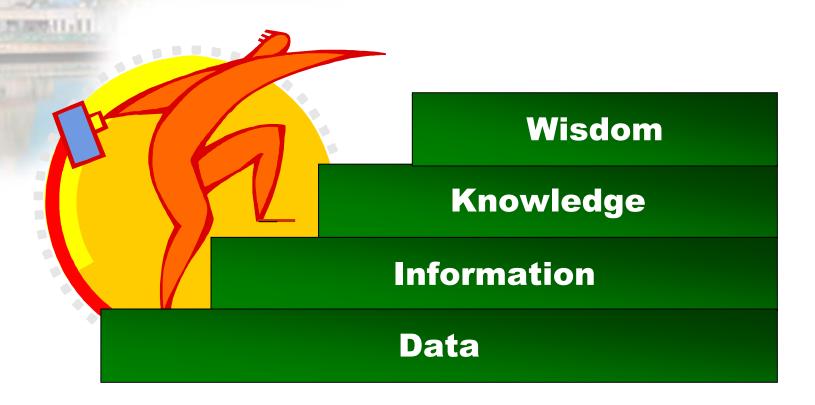
Friendly Work Process Interface



Asset Data Collection Interfaces

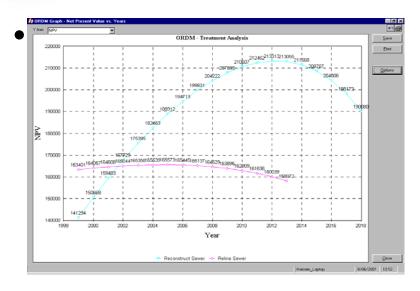


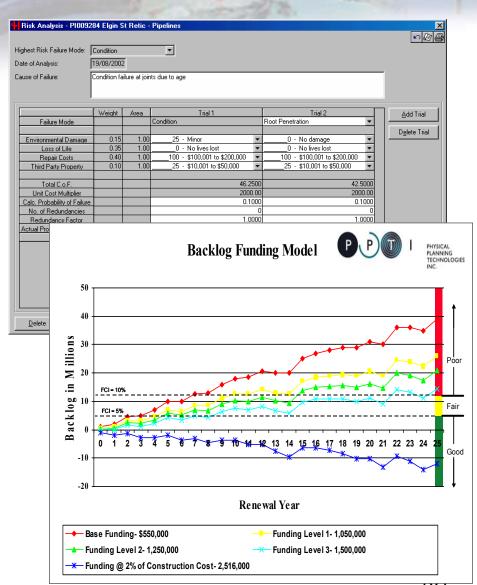
An AAM Program Is All About Knowledge Management



It's All About Better Decision Making

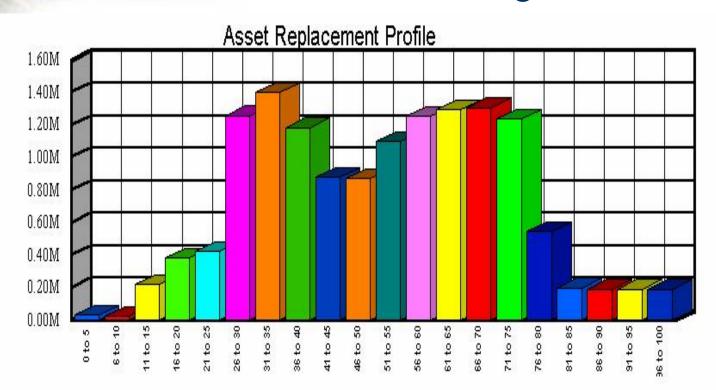
- Decision points
 - "Opex" & "Capex"
 - Optimal Renewal
 - Annuity renewal funding





Effective Presentation is Key to Good Decision Making





Displays asset replacement profile and related annuity (reserve) values for selected asset groups

Five Phases of AM IT Improvement

PHASE 1: Describe Current System Architecture and Structural Limits

PHASE 2: Determine Functionality "Gaps"

- > Itemize and define all functionalities that should be includ in a robust AMIS
- Identify which of those functionalities exist within the current IT support configuration
- ➤ Ascertain the adequacy of and satisfaction with the existing functionality
 - Compare to "Best of Breed"
 - ➤ Compare to "Best Appropriate Business Practice" and processes
- Identify gaps in functionality

PHASE 3: Identify "Gap Elimination Strategies"

- Identify available sources to acquire "gap functionalities" (vendors or custom programming)
- > Select a strategy to eliminate each of the functionality gaps

PHASE 4: Execute the Identified "Gap Elimination Strategies"

- > Select new systems
- Modify existing systems
- **➤** Integrate systems

PHASE 5: Train Personnel/Teams and Institutionalize

- > Set up training structure
- Develop content
- Execute

Output/Outcomes

Description

Output/Outcomes

- > "Model" AMIS structure
- > System functionality assessment
- Functionality gaps identified
- > Functionality specifications

Output/Outcomes

> Development/deployment strategies

Output/Outcomes

- Selection process
- Systems development work plan
- > Systems integration work plan

Output/Outcomes

- > Training program structure
- > Training program content
- > Training oversight

Skills Transfer Techniques



- "AM University"
 - Collaborative workshops
 - Classroom training
 - Side-by-side mentoring / "skills impact teams"
 - Brown bag training

- Peer-to-peer interviews
 - Knowledge Management System

AGENDA

Day 2

- Summary of Day 1; Outline of Day 2
- Case Study 1: Deploying An AAM Program
- Case Study 2: Developing And Funding A Lowest Life-cyclecost CIP
- Lunch
- Case Study 3: Meeting The IT Challenge Toward An Enterprise Asset Management System (EAMS)
- Summary, Addressing Your Questions, Comments, Self-audit

The International Infrastructure Management Manual

can be purchased online from:

www.ipwea.org.au

for approximately \$220 US

